UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
650 Capitol Mall, Suite 5-100
Sacramento, California 95814-4700

Refer to NMFS No: WCR-2018-9445

May 24, 2018

Mr. William Guthrie
Chief, California Delta Section, Regulatory Division
U.S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the 2018 – 2023 Port of Stockton Maintenance Dredging Program

Dear Mr. Guthrie:

Thank you for your September 20, 2017, letter, received by NOAA's National Marine Fisheries Service (NMFS) on October 2, 2017, requesting initiation of consultation with NMFS pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the annual maintenance dredging of the Port of Stockton for a 6-year period from 2018 through 2023.

This letter transmits NOAA's National Marine Fisheries Service's (NMFS) programmatic biological opinion (Enclosure 1) based on our review of the proposed maintenance dredging of docks 2 through 20 of the Port of Stockton (the project applicant) over a 6-year period from 2018 through 2023, and its effects on federally listed as threatened Sacramento River spring-run Chinook salmon (*Oncorhynchus tshawytscha*), California Central Valley steelhead (*O. mykiss*), threatened Southern distinct population segment (sDPS) of North American green sturgeon (*Acipenser medirostris*), and the designated critical habitats of California Central Valley steelhead and sDPS green sturgeon in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.).

This programmatic biological opinion is based on information provided by the U.S. Army Corps of Engineers (Corps) and the Port of Stockton, and a literature review completed by NMFS staff. A complete administrative record of this consultation is on file at the NMFS California Central Valley Office.

Based on the best available scientific and commercial information, the programmatic biological opinion concludes that maintenance dredging of the Port of Stockton over the 6-year period from 2018 through 2023 is not likely to adversely affect Sacramento River spring-run Chinook salmon, and not likely to jeopardize the continued existence of California Central Valley steelhead, the sDPS green sturgeon, or adversely modify or destroy designated critical habitats. NMFS also has included an incidental take statement with reasonable and prudent measures and non-discretionary terms and conditions that are necessary and appropriate to minimize incidental take of listed anadromous fish species associated with the maintenance dredging.

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act [MSA, 16 U.S.C. 1855(b)] for this action. The enclosed biological opinion also includes documentation of NMFS's conclusion that the proposed project will adversely affect the EFH of Pacific salmon in the action area. NMFS has determined, however, that the Port of Stockton in the San Joaquin River is an existing channel that has been the subject of previous EFH consultations assessing the impacts of maintenance dredging activities, and that the Corps has previously received and implemented conservation recommendations from NMFS intended to avoid, minimize, mitigate, or otherwise offset adverse effects to Pacific salmon EFH as a result of routine maintenance dredging activities in this channel. Therefore, no additional conservation recommendations beyond what has been offered and implemented previously are being provided at this time.

We appreciate your continued cooperation in the conservation of listed species and their habitat, and look forward to working with you and your staff in the future. Please contact Douglas Hampton of my staff at (916) 930-3610, or via e-mail at Douglas.Hampton@noaa.gov, if you have any questions or require additional information concerning this project.

Sincerely,

Maria Rea

for Barry A. Thom
Regional Administrator

Enclosure

cc: To the file: ARN 151422-WCR2017-SA00380

Mr. Jason Cashman, Port of Stockton, P.O. Box 2089, Stockton, California 95201

Ms. Katie Chamberlain, Anchor QEA, LLC, 130 Battery Street, Suite 400, San Francisco, California 9411

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Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Response

2018 – 2023 Port of Stockton Maintenance Dredging Program

National Marine Fisheries Service Consultation Number: *WCR-2018-9445*

Action Agency: U.S. Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened	No	N/A	N/A	N/A
California Central Valley steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Southern distinct population segment of North American Green Sturgeon (*Acipenser medirostis*)	Threatened	Yes	No	Yes	No

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	No

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By: Maria Rea

for Barry A. Thom
Regional Administrator

Date: May 24, 2018

TABLE OF CONTENTS

1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

1.1 Background

NOAA's National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.), and implementing regulations at 50 CFR 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA, 16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available through NMFS' Public Consultation Tracking System (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). A complete administrative record of this consultation is on file at the NMFS California Central Valley Office located in Sacramento, California.

1.2 Consultation History

The consultation history for the 2018 - 2023 Port of Stockton Maintenance Dredging Program is as follows:

- On October 2, 2017, NMFS received a letter, and enclosed biological assessment (BA), dated September 20, 2017, from the U.S. Army Corps of Engineers (Corps) requesting the initiation of consultation pursuant to section 7 of the ESA in support of the issuance of a Department of the Army permit to the Port of Stockton for the 2018 – 2023 Programmatic Maintenance Dredging project
- In November 2017, NMFS determined the BA submitted with the request for the initiation of consultation was sufficient.
- On April 17, 2018, NMFS received an email from the Corps extending the timeline for the issuance of a biological opinion until June 5, 2018.

This opinion analyzes the effects of the Port of Stockton Maintenance Dredging Program for the years 2018 - 2023 on California Central Valley (CCV) steelhead (*Oncorhynchus mykiss*), the Southern distinct population segment (sDPS) of North American green sturgeon (*Acipenser medirostris*), and their designated critical habitats.

1.3 Proposed Federal Action

“Action” means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). Similarly, the definition of a Federal action pursuant to the MSA means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910).

“Interrelated actions” are those that are part of a larger action and depend on the larger action for their justification. “Interdependent actions” are those that have no independent utility apart from the action under consideration (50 CFR 402.02). There are no interdependent or interrelated activities associated with the proposed Federal action.

The U.S. Army Corps of Engineers (Corps) proposes to issue a Department of the Army permit to the Port of Stockton (Port), authorizing the Port to conduct routine annual maintenance dredging at docks 2 through 20 of the Port of Stockton over a 6-year period from 2018 through 2023. The Port is located within the Stockton Deep Water Ship Channel (DWSC) on the San Joaquin River in the City of Stockton in San Joaquin County, California, approximately 75 miles east of San Francisco and 40 miles southeast of Sacramento (Figure 1).

Figure 1. Port of Stockton

Dredging will be conducted each year on an as needed basis in order to maintain authorized depths, and will be limited to the operational period from July 1 through November 30 each year. During the operational period of in-water activity, dredging could occur at any time, 24 hours a day, 7 days a week. Dredging might not occur at all in some years, however, if it is deemed unnecessary in any given year during the 6-year period. The Port proposes to conduct annual dredging operations to maintain the authorized depth of -35 feet mean lower low water (MLLW) at Docks 2 through 11 and 14 through 20, and to the authorized depth of -40 feet MLLW at Docks 12 and 13, with an additional 2 feet of over depth in all areas (approximately 1,788,600 square feet or 41 acres). Based on recent bathymetric surveys, the current volume of sediment accumulated between existing and maintained depths (-35 or -40 feet MLLW and 2 feet of over depth) at the Port docks is approximately 107,131 cubic yards. This represents the volume of sediment that would need to be removed from the docks for the Port to be operating at its maximum allowable depths under existing and past permits and approvals. Based on an estimate derived from recent and historic sedimentation rates compared to recent bathymetric surveys, and in consideration of the effect the recent drought has likely had over sedimentation rates in the Delta generally, the Port estimates that the maximum depth of sediment that would accumulate across the entire dock area over a single year would be approximately 0.8 foot. This estimate results in an annual sedimentation volume of 53,100 cubic yards and a 6-year total sedimentation volume of 265,500 cubic yards for all the Port docks. The combined total dredging volume (existing plus estimated future sedimentation requiring removal) over the 6-year period is 372,631 cubic yards. Table 1 summarizes the existing and forecasted maintenance dredging needs for docks 2 through 20 over the 6-year period. The specific method of sediment removal employed by the Port will include the use of a hydraulic suction cutter head dredge and/or a mechanical clamshell dredge, both of which are described in greater detail in the following sections.

Table 1. Port of Stockton Existing and Forecasted Maintenance Dredging Needs (2018-2023)

Dock Number	Total Dock Area (square feet)	Existing Volume to Achieve -35 ft MLLW Plus 2 ft Overdepth (cubic yards)	Estimated Annual Sedimentation Volume (cubic yards)	Estimated 6-Year Total Sedimentation Volume (cubic yards)	Existing Plus Estimated Volume over Period of 6 Years (cubic yards)
Docks 2 and 3	99,000	6,685	2,900	14,500	21,185
Dock 4 and 5	171,700	8,857	5,100	25,500	34,357
Dock 6	76,400	7,982	2,300	11,500	19,482
Docks 7 and 8	183,100	11,687	5,400	27,000	38,687
Docks 9, 10, and 11	244,600	6,402	7,300	36,500	42,902
Docks 12 and 13	136,300	15,0841	4,000	20,000	35,084
Docks 14 and 15	259,000	9,716	7,700	38,500	48,216
Dock 16	105,000	8,102	3,100	15,500	23,602
Dock 17	117,900	8,668	3,500	17,500	26,168
Dock 18	116,800	5,705	3,500	17,500	23,205
Docks 19 and 19A	166,900	9,340	5,000	25,000	34,340
Dock 20	111,900	8,903	3,300	16,500	25,403
Total	**1,788,600**	**107,131**	**53,100**	**265,500**	**372,631**

Hydraulic Dredging

The Port will primarily use a 1,500- to 2,000-horsepower hydraulic dredge for dock maintenance dredging. A hydraulic dredge is a barge-type vessel that consists of an onboard pump(s), spud piles, and a toothed cutter head attached to a flexible pipeline. The cutter head is mounted to a ladder that can be lowered, raised, and angled to facilitate and increase the dredge's access to a greater swath of substrate for removal. The pipeline is constructed out of durable plastic and serves to transport dredge spoils (sediment) from the vessel to the dredged material placement site (DMPS). Additional sections of flexible pipeline can be added to the pipeline opening as needed in order to convey the spoils over a greater distance. The pipeline sections are anchored to the channel bottom by spud piles spaced approximately 500 feet apart from each other.

Mechanical Dredging

The Port will employ mechanical clamshell dredging techniques on an as-needed basis in order to remove material with potentially large debris present at or below the surface of the dredge area, which has damaged hydraulic dredging equipment in the past. A mechanical dredge consists of a crane mounted on a floating deck barge with a clamshell bucket on the end of the crane boom. The barge will be anchored to the channel bottom by 2 to 4 spud piles and will require a tug boat or tow to move the dredge since clamshell dredges are not self-propelled. Once the barge is maneuvered into position, the spud piles will be driven vertically into the channel bottom with hydraulic assistance. The clamshell, powered by a diesel generator, will then be raised and lowered through the water column using a series of cables and winches. The weight of the clamshell allows it to fall through the water column into the sediment below, with the cables restricting the depth to which the clamshell can descend and thereby preventing it from extending beyond the maximum allowable over depth. Once on the bottom, the clamshell closes and is pulled up through the water column and positioned over a scow where the clamshell is then opened, allowing the dredged material to be deposited into the scow. Unlike hydraulic dredging, little additional water is entrained by mechanical dredging equipment. Once all the material within reach of the clamshell is dredged, the spud piles will be raised and the tug will transport the barge to the next location requiring dredging. This process will continue until all the material to be dredged has been removed. Once a scow has been filled with dredged material, it will be transported by tug to one of the approved DMPSs where a hydraulic pump may be used to pipe the dredged material from the loaded scow to the DMPS. Alternatively, an excavator operated from within the DMPS or along the berm of the DMPS can be used to offload dredged material from the scow, although this approach is generally less efficient.

Large Debris Removal

During historical U.S. Navy operations at Rough and Ready Island, metal debris was deposited in the sediment adjacent to the Port docks in the West Complex. It is anticipated that the majority of this debris was previously removed during past dredging episodes, and therefore, debris removal is expected to be minimal, if necessary at all. However, should debris of this type be encountered, it will be removed by clamshell mechanical dredging methods as described above, modified only to comport with the specific sequence implemented during previous dredging episodes and described below. First the hydraulic equipment would be shut down and divers would be sent down to investigate the object and develop a plan for its removal. If necessary, a diver will connect a cable from the object to a crane capable of lifting heavy objects, which would then slowly remove the object through a series of gentle and discreet movements designed to minimize sediment disturbance, and place it onto a barge or nearby dock for appropriate recycling or disposal.

Dredged Material Placement and Dewatering

Dredged material will be placed at one of two DMPSs -- Roberts Island DMPS or Rough and Ready Island DMPS -- both of which are described in greater detail below. In general, however, dredged material and slurry will be pumped onto one of the two DMPSs by pipeline, where water from the dredge slurry will be allowed to pond up on the particular DMPS where the material is placed. The dredged material will then be allowed to dewater through natural evaporation and soil filtration processes. Ponded water in the DMPSs will be monitored on a weekly basis until it is less than 6 inches deep, as required by the Central Valley Regional Water Quality Control Board's General Order regarding the general discharge requirements for dredging operations in the Sacramento San Joaquin Delta (CVRWQCB 2009). Once the dredged material has been dewatered and dried, the Port can excavate the sediment from the DMPS and reuse it for beneficial purposes throughout the year. Perimeter berms surrounding the DMPSs will be maintained at a maximum height of 8 feet by the Port, which will fill the DMPS with dredged material and slurry to a depth of no more than 6 feet, thereby allowing at least 2 feet of freeboard in the DMPS at all times.

<u>Dredged Material Placement Sites</u>

The Roberts Island DMPS is an approximately 400-acre upland area located along the northern margin of Roberts Island opposite Buckley Cove. It is owned and operated by the Port, and has functioned as a placement site for the Port since 1982. The site slopes gently westward away from the Stockton DWSC and is surrounded by 8-foot-high berms. The Port maintains a series of internal berms and dikes within the placement site to contain slurry and allow for sediments to settle in specific portions of the site. The locations of these features can vary over time and are ultimately dependent on annual dredged material placement needs. The current capacity of the Roberts Island DMPS is approximately 4 million cubic yards.

The Rough and Ready Island DMPS is an approximately 50-acre upland area located in the southeast quadrant of Rough and Ready Island to the north of Burns Cutoff. It has been in use since 2013, and is owned and operated by the Port. The site slopes gently to the northwest and is maintained similarly to the Roberts Island DMPS. The current placement capacity of the Rough and Ready Island DMPS is approximately 500,000 cubic yards.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1 Analytical Approach

This opinion includes both a jeopardy analysis and/or an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of" a listed species, which is "to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This opinion relies on the definition of "destruction or adverse modification," which “means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features” (81 FR 7214, February 11, 2016).

The designations of critical habitat for some species use the term primary constituent element (PCE) or essential features. The new critical habitat regulations (81 FR 7414, February 11, 2016) replace this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a “destruction or adverse modification” analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an “exposure-response-risk” approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors by: (1) Reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the proposed action poses to species and critical habitat.
- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
- If necessary, suggest a RPA to the proposed action.

The Corps has determined that the action may affect, and is likely to adversely affect, the Federally listed Central Valley spring-run Chinook salmon (*O. tshawytscha*), CCV steelhead, the sDPS green sturgeon, and the designated critical habitats for CCV steelhead and the sDPS green sturgeon. Based on the timing and location of the proposed action, NMFS has determined that the proposed action may affect, and is likely to adversely affect CCV steelhead, the sDPS of North American green sturgeon, and their designated critical habitats. NMFS has independently determined, however, that the proposed action is not likely to adversely affect Central Valley spring-run Chinook salmon. The rationale supporting that determination is documented in the "Not Likely to Adversely Affect" Determinations section (2.12). The remainder of this opinion will focus on the analysis of effects to CCV steelhead and sDPS green sturgeon in support of those conclusions.

This opinion assesses the effects of annual maintenance dredging of docks 2 through 20 in the Port of Stockton over a 6-year period on CCV steelhead, the sDPS green sturgeon, and their designated critical habitats. To conduct this assessment, NMFS examined information from a variety of sources. Detailed background information on the status of these species and critical habitat has been published in a number of documents including peer reviewed scientific journals, primary reference materials, government and non-government reports, the Biological Assessment (BA) prepared for the Port of Stockton in support of their maintenance dredging program for the years 2018 - 2023, and supplemental material provided by the Corps and the Port during the course of the consultation, including reports and results emanating from monitoring conducted in conjunction with the implementation of the Corps maintenance dredging activities in the Sacramento and Stockton DWSCs in past years.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that are likely to be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential PBFs that help to form that conservation value.

The following federally listed species and designated critical habitats occur in the action area and may be affected by the proposed Port of Stockton Maintenance Dredging Program:

California Central Valley steelhead DPS (*Oncorhynchus mykiss*)
Listed as threatened (71 FR 834, January 5, 2006)

California Central Valley steelhead designated critical habitat
(70 FR 52488, September 2, 2005)

Southern DPS of North American green sturgeon (*Acipenser medirostris*)
Listed as threatened (71 FR 17757, April 7, 2006)

Southern DPS of North American green sturgeon designated critical habitat
(74 FR 52300, October 9, 2009)

2.2.1 California Central Valley Steelhead DPS

Historic CCV steelhead run sizes are difficult to estimate given the paucity of data, but may have approached one to two million adults annually (McEwan 2001). By the early 1960s, the steelhead run size in the Central Valley had declined to about 40,000 adults (McEwan 2001). Current abundance data for CCV steelhead are limited to returns to hatcheries and redd surveys conducted on a few rivers. The hatchery data are the most reliable because redd surveys for steelhead are often made difficult by high flows and turbid water usually present during the winter-spring spawning period.

CCV steelhead returns to Coleman National Fish Hatchery (CNFH) increased from 2011 to 2014. After reaching a low of only 790 fish in 2010, 2013 and 2014 have averaged 2,895 fish. Wild adults counted at the hatchery each year represent a small fraction of overall returns, but their numbers have remained relatively steady, typically 200 to 300 fish each year. Numbers of wild adults returning each year ranged from 252 to 610 from 2010 to 2014, respectively.

Redd counts are conducted in the American River and in Clear Creek (Shasta County). An average of 143 redds have been counted on the American River from 2002 to 2015 (data from Hannon et al. 2003, Hannon and Deason 2008, Chase 2010). An average of 178 redds have been counted in Clear Creek from 2001 to 2015 following the removal of Saeltzer Dam, which allowed steelhead access to additional spawning habitat. The Clear Creek redd counts range from 100 to 1,023 and indicates an upward trend in abundance since 2006 [U.S. Fish and Wildlife Service (USFWS) 2015].

The returns of CCV steelhead to the Feather River Fish Hatchery experienced a sharp decrease from 2003 to 2010, with only 679, 312, and 86 fish returning in 2008, 2009 and 2010, respectively. In recent years, however, returns have experienced an increase, with 830, 1,797, and 1,505 fish returning in 2012, 2013, and 2014, respectively. Overall, steelhead returns to hatcheries have fluctuated so much from 2001 to 2015 that no clear trend is present.

An estimated 100,000 to 300,000 naturally produced juvenile steelhead are estimated to leave the Central Valley annually, based on rough calculations from sporadic catches in trawl gear (Good et al. 2005). Nobriga and Cadrett (2001) used the ratio of adipose fin-clipped (hatchery) to unclipped (wild) steelhead smolt catch ratios in the USFWS Chipps Island trawl from 1998 through 2000 to estimate that about 400,000 to 700,000 steelhead smolts are produced naturally each year in the Central Valley. Trawl data indicate that the level of natural production of steelhead has remained very low since the 2011 status review, suggesting a decline in natural production based on consistent hatchery releases. Catches of steelhead at the fish collection facilities in the southern Delta are another source of information on the production of wild steelhead relative to hatchery steelhead (CDFW 2017). The overall catch of steelhead has declined dramatically since the early 2000s, with an overall average of 2,705 in the last 10 years. The percentage of wild (unclipped) fish in salvage has fluctuated, but has leveled off to an average of 36 percent since a high of 93 percent in 1999.

About 80 percent of the historical spawning and rearing habitat once used by CCV steelhead in the Central Valley is now upstream of impassible dams (Lindley et al. 2006). Many historical populations of CCV steelhead are entirely above impassable barriers and may persist as resident or adfluvial rainbow trout, although they are presently not considered part of the DPS. Steelhead are well-distributed throughout the Central Valley below the major rim dams (Good et al. 2005, NMFS 2016). Most of the steelhead populations in the Central Valley have a high hatchery component, including Battle Creek (adults intercepted at the CNFH weir), the American River, Feather River, and Mokelumne River.

The CCV steelhead abundance and growth rates continue to decline, largely the result of a significant reduction in the amount and diversity of habitats available to these populations

(Lindley et al. 2006). Recent reductions in population size are supported by genetic analysis (Nielsen et al. 2003). Garza and Pearse (2008) analyzed the genetic relationships among CCV steelhead populations and found that unlike the situation in coastal California watersheds, fish below barriers in the Central Valley were often more closely related to below barrier fish from other watersheds than to *O. mykiss* above barriers in the same watershed. This pattern suggests the ancestral genetic structure is still relatively intact above barriers, but may have been altered below barriers by stock transfers. The genetic diversity of CCV steelhead is also compromised by hatchery origin fish, placing the natural population at a high risk of extinction (Lindley et al. 2007). Steelhead in the Central Valley historically consisted of both summer-run and winter-run migratory forms. Only winter-run (ocean maturing) steelhead currently are found in California Central Valley rivers and streams as summer-run have been extirpated (McEwan and Jackson 1996, Moyle 2002).

Although CCV steelhead will experience similar effects of climate change to Chinook salmon in the Central Valley, as they are also blocked from the vast majority of their historic spawning and rearing habitat, the effects may be even greater in some cases, as juvenile steelhead need to rear in the stream for one to two summers prior to emigrating as smolts. In the Central Valley, summer and fall temperatures below the dams in many streams already exceed the recommended temperatures for optimal growth of juvenile steelhead, which range from 57 degrees Fahrenheit (°F) to 66°F [14 degrees Celsius (°C) to 19°C]. Several studies have found that steelhead require colder water temperatures for spawning and embryo incubation than salmon (McCullough et al. 2001). In fact, McCullough et al. (2001) recommended an optimal incubation temperature at or below 52°F to 55°F (11°C to 13°C). Successful smoltification in steelhead may be impaired by temperatures above 54°F (12°C), as reported in Richter and Kolmes (2005). As stream temperatures warm due to climate change, the growth rates of juvenile steelhead could increase in some systems that are currently relatively cold, but potentially at the expense of decreased survival due to higher metabolic demands and greater presence and activity of predators. Stream temperatures that are currently marginal for spawning and rearing may become too warm to support wild steelhead populations.

All indications are that natural CCV steelhead have continued to decrease in abundance and in the proportion of natural fish over the past 25 years (NMFS 2016); the long-term trend remains negative. Hatchery production and returns are dominant. Most wild CCV populations are very small and may lack the resiliency to persist for protracted periods if subjected to additional stressors, particularly widespread stressors such as climate change. The genetic diversity of CCV steelhead has likely been impacted by low population sizes and high numbers of hatchery fish relative to wild fish. In summary, the status of the CCV steelhead DPS appears to have remained unchanged since the 2011 status review, and the DPS is likely to become endangered within the near future throughout all or a significant portion of its range (NMFS 2016).

2.2.2 California Central Valley Steelhead Designated Critical Habitat

The critical habitat designation for CCV steelhead (70 FR 52488; September 2, 2005) lists freshwater spawning sites; freshwater rearing sites; freshwater migration corridors; and estuarine areas as the PBFs. The geographical extent of designated critical habitat includes the Sacramento, Feather, and Yuba rivers and the Deer, Mill, Battle, and Antelope creeks in the

Sacramento River basin; the San Joaquin River, including its tributaries but excluding the mainstem San Joaquin River above the Merced River confluence; and the waterways of the Delta.

Many of the PBFs of CCV steelhead critical habitat are degraded and provide limited high quality habitat. Passage to historical spawning and juvenile rearing habitat has been largely reduced due to construction of dams throughout the Central Valley. Levee construction has also degraded the freshwater rearing and migration habitat and estuarine areas as riparian vegetation has been removed, reducing habitat complexity and food resources and resulting in many other ecological effects. Contaminant loading and poor water quality in central California waterways pose threats to lotic fish, their habitat, and food resources. Additionally, due to reduced access to historical habitats, genetic introgression is occurring because naturally produced fish are interacting with hatchery-produced fish, which has the potential to reduce the long-term fitness and survival of this species.

Although the current conditions of CCV steelhead critical habitat are significantly degraded, the spawning habitat, migratory corridors, and rearing habitat that remain in the Sacramento-San Joaquin River watersheds and the Delta are considered to have high intrinsic value for the conservation of the species as they are critical to ongoing recovery efforts.

2.2.3 Southern DPS of North American Green Sturgeon

Green sturgeon are known to range from Baja California to the Bering Sea along the North American continental shelf. During late summer and early fall, subadults and non-spawning adult green sturgeon can frequently be found aggregating in estuaries along the Pacific coast (Emmett et al. 1991, Moser and Lindley 2006). Using polyploid microsatellite data, Israel et al. (2009) found that green sturgeon within the Central Valley of California belong to the sDPS. Additionally, acoustic tagging studies have found that green sturgeon found spawning within the Sacramento River are exclusively sDPS green sturgeon (Lindley et al. 2011). In waters inland from the Golden Gate Bridge in California, sDPS green sturgeon are known to range through the estuary and the Delta and up the Sacramento, Feather, and Yuba rivers (Israel et al. 2009, Cramer Fish Sciences 2011, Seesholtz et al. 2014). It is unlikely that green sturgeon utilize areas of the San Joaquin River upriver of the Delta with regularity, and spawning events are thought to be limited to the upper Sacramento River and its tributaries. There is no known modern usage of the upper San Joaquin River by green sturgeon, and adult spawning has not been documented there (Jackson and Eenennaam 2013).

Recent research indicates that the sDPS is composed of a single, independent population, which principally spawns in the mainstem Sacramento River and also breeds opportunistically in the Feather River and possibly the Yuba River (Cramer Fish Sciences 2011, Seesholtz et al. 2014). Concentration of adults into a very few select spawning locations makes the species highly vulnerable to poaching and catastrophic events. Whether sDPS green sturgeon display diverse phenotypic traits, such as ocean behavior, age at maturity, and fecundity, or if there is sufficient diversity to buffer against long-term extinction risk is not well understood. It is likely that the diversity of sDPS green sturgeon is low, given recent abundance estimates (NMFS 2015).

Trends in abundance of sDPS green sturgeon have been estimated from two long-term data sources: (1) salvage numbers at the state and Federal pumping facilities (CDFW 2017), and (2) by incidental catch of green sturgeon by the CDFW's white sturgeon sampling/tagging program (Dubois and Harris 2015, 2016). Historical estimates from these sources are likely unreliable because the sDPS was likely not taken into account in incidental catch data, and salvage does not capture rangewide abundance in all water year types. A decrease in sDPS green sturgeon abundance has been inferred from the amount of take observed at the south Delta pumping facilities of the Central Valley Project (CVP) and the State Water Project (SWP). These data should be interpreted with some caution. Operations and practices at the facilities have changed over the project lifetime, which may affect salvage data. These data likely indicate a high production year versus a low production year qualitatively, but cannot be used to rigorously quantify abundance.

Since 2010, more robust estimates of sDPS green sturgeon have been generated. As part of a doctoral thesis at the University of California at Davis (UC Davis), Ethan Mora has been using acoustic telemetry to locate green sturgeon in the Sacramento River and to derive an adult spawner abundance estimate (Mora et al. 2015). Preliminary results of these surveys estimate an average annual spawning run of 223 (using DIDSON cameras) and 236 (using telemetered fish). This estimate does not include the number of spawning adults in the lower Feather or Yuba rivers, where green sturgeon spawning was recently confirmed (Seesholtz et al. 2014).

The parameters of green sturgeon population growth rate and carrying capacity in the Sacramento Basin are poorly understood. Larval count data show enormous variance among sampling years. In general, sDPS green sturgeon year class strength appears to be highly variable with overall abundance dependent upon a few successful spawning events (NMFS 2010). Other indicators of productivity such as data for cohort replacement ratios and spawner abundance trends are not currently available for sDPS green sturgeon.

The sDPS green sturgeon spawn primarily in the Sacramento River in the spring and summer. The Anderson-Cottonwood Irrigation District Diversion Dam (ACID) is considered the upriver extent of green sturgeon passage in the Sacramento River (71 FR 17757, April 7, 2006). The upriver extent of green sturgeon spawning, however, is approximately 30 kilometers downriver of ACID where water temperature is higher than ACID during late spring and summer (Heublein et al. in review). Thus, if water temperatures increase with climate change, temperatures adjacent to ACID may remain within tolerable levels for the embryonic and larval life stages of green sturgeon, but temperatures at spawning locations lower in the river may be more affected. It is uncertain, however, if green sturgeon spawning habitat exists closer to ACID, which could allow spawning to shift upstream in response to climate change effects. Successful spawning of green sturgeon in other accessible habitats in the Central Valley (i.e., the Feather River) is limited, in part, by late spring and summer water temperatures (NMFS 2015). Similar to salmonids in the Central Valley, green sturgeon spawning in tributaries to the Sacramento River is likely to be further limited if water temperatures increase and higher elevation habitats remain inaccessible.

The viability of sDPS green sturgeon is constrained by factors such as a small population size, lack of multiple populations, and concentration of spawning sites into just a few locations. The risk of extinction is believed to be moderate (NMFS 2010). Although threats due to habitat alteration are thought to be high and indirect evidence suggests a decline in abundance, there is much uncertainty regarding the scope of threats and the viability of population abundance indices (NMFS 2010). Lindley et al. (2007), in discussing winter-run Chinook salmon, states that an ESU (or DPS) represented by a single population at moderate risk of extinction is at high risk of extinction over a large timescale; this would apply to the sDPS for green sturgeon. The most recent 5-year status review for sDPS green sturgeon found that some threats to the species have recently been eliminated such as take from commercial fisheries and removal of some passage barriers (NMFS 2015). Since many of the threats cited in the original listing still exist, the threatened status of the DPS is still applicable (NMFS 2015).

2.2.4 Southern DPS of North American Green Sturgeon Designated Critical Habitat

The critical habitat designation for sDPS green sturgeon (74 FR 52300; October 9, 2009) lists the PBFs for both freshwater riverine systems and estuarine habitats as: food resources, water flow, water quality, migratory corridor, depth, and sediment quality. Additionally, substrate type or size is also a PBF for freshwater riverine systems. In addition, the PBFs include migratory corridor, water quality, and food resources in nearshore coastal marine areas.

Currently, many of the PBFs of sDPS green sturgeon are degraded and provide limited high quality habitat. Factors that lessen the quality of migratory corridors for juveniles include unscreened or inadequately screened diversions, altered flows in the Delta, and presence of contaminants in sediment. Although the current conditions of green sturgeon critical habitat are significantly degraded, the spawning habitat, migratory corridors, and rearing habitat that remain in both the Sacramento-San Joaquin River watersheds, the Delta, and nearshore coastal areas are considered to have high intrinsic value for the conservation of the species.

2.3 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area includes the entire width of the San Joaquin River where it flows through the Port of Stockton in the City of Stockton, and extends for a distance of 500 feet downstream from the most downstream portion of the areas proposed to be dredged. This area was selected because it represents the furthest point downstream of the proposed work areas that the anticipated effects related to suspended sediments and turbidity are likely to occur.

2.4 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

2.4.1 Status of the Species in the Action Area

The action area functions primarily as a migratory corridor for adult and juvenile CCV steelhead. All adult CCV steelhead originating in the San Joaquin River watershed will have to migrate through the action area in order to reach their spawning grounds and to return to the ocean following spawning. Likewise, all CCV steelhead smolts originating in the San Joaquin River watershed will also have to pass through the action area during their emigration to the ocean. The waterways in the action area also are expected to provide some rearing benefit to emigrating steelhead smolts as they move through the action area.

The action area also functions as holding and rearing habitat for adult, sub-adult, and juvenile sDPS green sturgeon. While some post-spawn adults may linger or roam throughout the Delta during their migration back to the ocean, the majority of spawning and post-spawn adults are unlikely to migrate through the action area because their principal migratory route between the ocean and their spawning habitat in the Sacramento and Feather rivers lies along the channels of the north Delta leading up the Sacramento River. Because of the wide ranging and year-round presence of the juvenile and sub-adult life stages throughout the Delta, however, NMFS anticipates those life stages are more likely to be present in the action area during dredging operations.

2.4.1.1 California Central Valley Steelhead DPS

CCV steelhead occur in both the Sacramento River and the San Joaquin River watersheds, although the spawning population of fish is much greater in the Sacramento River watershed (NMFS 2016). Sacramento River steelhead can be drawn into the south Delta by the actions of the CVP and SWP water diversion facilities. Small, remnant populations of CCV steelhead are also known to occur on the Stanislaus River and the Tuolumne River and their presence is assumed on the Merced River due to proximity, similar habitats, and historical presence. CCV steelhead smolts first start to appear in the action area in November based on the records from the CVP and SWP fish salvage facilities. Their presence increases through December and January (21.6 percent of average annual salvage) and peaks in February (37.0 percent) and March (31.1 percent) before rapidly declining in April (7.7 percent). By June, the emigration has essentially ended, with only a small number of fish being salvaged through the summer at the CVP and SWP. Kodiak trawls conducted by the USFWS and CDFW on the mainstem of the San Joaquin River just upstream from the head of Old River during the Vernalis Adaptive Management Program (VAMP) experimental period routinely catch low numbers of outmigrating steelhead smolts from the San Joaquin Basin. Monitoring is less frequent prior to the VAMP, therefore emigrating steelhead smolts have a lower probability of being detected. Rotary Screw Trap (RST) monitoring on the Stanislaus River at Caswell State Park and further upriver near the City of Oakdale indicate that smolt-sized fish start emigrating downriver in January and can continue through late May. Fry-sized fish (30 to 50 mm) are captured at the Oakdale RST starting as early as April and continuing through June. Adult escapement numbers have been monitored for the past several years with the installation of an Alaskan style weir on the lower Stanislaus River between Ripon and Riverbank. Typically, very few adult steelhead have been observed moving upstream past the weir due to the removal of the structure at the end of December. However, in 2006 to 2007, the weir was left in place through the winter and spring, and seven adult steelhead were counted moving upstream. In 2008-2009, 15 adult steelhead moved upstream past the weir. The weir counts indicate that at least some adult steelhead are moving upstream from the lower Stanislaus River into upstream areas. These fish, due to their migratory behavior, timing of entrance, and typically larger size would be considered potential steelhead returning to the tributary.

2.4.1.2 Southern DPS of North American Green Sturgeon

Juvenile green sturgeon from the sDPS are routinely collected at the SWP and CVP fish salvage facilities throughout the year. Based on the salvage records from 1981 through 2007, green sturgeon may be present during any month of the year, and have been particularly prevalent during July and August. The sizes of these fish are less than 1 meter and average 330 mm with a range of 136 mm to 774 mm. The size range indicates that these are sub-adult fish rather than adult or larval/juvenile fish. Recent telemetry data and sturgeon acoustic tracking, as reported by Thomas et al. (2013), indicate that these sub-adult fish utilize the Delta for rearing for a period of up to approximately 3 years. The proximity of the CVP and SWP fish salvage facilities to the action area would indicate that sub-adult green sturgeon have some potential to be present within the action area during the annual dredging operations in the Stockton DWSC, but that their population density would be low in these waters.

2.4.2 Status of Designated Critical Habitats in the Action Area

The action area occurs within the San Joaquin Delta hydrologic unit ([HU] 18040003) and is included in the critical habitat designated for CCV steelhead. The San Joaquin Delta HU is in the southwestern portion of CCV steelhead range and includes portions of the south and central Delta channel complex. The San Joaquin Delta HU encompasses approximately 628 square miles, with 455 miles of stream channels (at 1:100,000 hydrography). The critical habitat analytical review team identified approximately 276 miles of occupied riverine/estuarine habitat in this hydrologic subunit area, and that it contained one or more PBFs for CCV steelhead (NMFS 2005). The PBFs of steelhead critical habitat within the action area include freshwater rearing habitat and freshwater migration corridors. The features of the PBFs included in these different sites essential to the conservation of the CCV steelhead DPS include the following: sufficient water quantity and floodplain connectivity to form and maintain physical habitat conditions necessary for salmonid development and mobility, sufficient water quality, food and nutrients sources, natural cover and shelter, migration routes free from obstructions, no excessive predation, holding areas for juveniles and adults, and shallow water areas and wetlands. Habitat within the action area is primarily utilized for freshwater rearing and migration by CCV steelhead juveniles and smolts and for adult freshwater migration. No spawning of CCV steelhead occurs within the action area.

In regards to the designated critical habitat for sDPS green sturgeon, the action area includes the following PBFs: adequate food resources for all life stages utilizing the Delta; water flows sufficient to allow adults, subadults, and juveniles to orient to flows for migration and normal behavioral responses; water quality sufficient to allow normal physiological and behavioral responses; unobstructed migratory corridors for all life stages utilizing the Delta; a broad spectrum of water depths to satisfy the needs of the different life stages present in the estuary;

and sediment with sufficiently low contaminant burdens to allow for normal physiological and behavioral responses to the environment.

The general condition and function of this habitat for both CCV steelhead and sDPS green sturgeon has already been described in the *Status of the Species and Critical Habitat* section of this opinion. The substantial degradation over time of several of the essential critical elements has diminished the function and condition of the freshwater rearing and migratory habitats in the action area. It has only rudimentary functions compared to its historical status. The channels of the south Delta have been heavily riprapped with coarse stone slope protection on artificial levee banks and these channels have been straightened to enhance water conveyance through the system. The extensive riprapping and levee construction has precluded natural river channel migrations and the formation of riffle pool configurations in the Delta's channels. The natural floodplains have essentially been eliminated, and the once extensive wetlands and riparian zones have been cleared for farming. Little riparian vegetation remains in the south Delta, limited mainly to tules growing along the foot of artificial levee banks. Numerous artificial channels also have been created to bring water to irrigated lands that historically did not have access to the river channels (i.e., Victoria Canal, Grant Line Canal, Fabian and Bell Canal, Woodward Cut, etc.). These artificial channels have disturbed the natural flow of water through the south Delta. As a byproduct of this intensive engineering of the Delta's hydrology, numerous irrigation diversions have been placed along the banks of the flood control levees to divert water from the area's waterways to the agricultural lands of the Delta's numerous "reclaimed" islands. Most of these diversions are not screened adequately to protect migrating fish from entrainment. Sections of the south Delta have been routinely dredged to provide adequate intake depth to these agricultural water diversions in order to reduce the probability of pump cavitation or loss of head on siphons.

Water flow through the south Delta is highly manipulated to serve human purposes. Rainfall and snowmelt is captured by reservoirs in the upper watersheds, from which its release is dictated primarily by downstream human needs. The SWP and CVP pumps draw water towards the southwest corner of the Delta which creates a net upstream flow of water towards their intake points. Fish, and the forage base they depend upon for food, represented by free floating phytoplankton and zooplankton, as well as larval, juvenile, and adult forms, are drawn along with the current towards these diversion points. In addition to the altered flow patterns in the south Delta, numerous discharges of treated wastewater from sanitation wastewater treatment plants (e.g., Cities of Tracy, Stockton, Manteca, Lathrop, Modesto, Turlock, Riverbank, Oakdale, Ripon, Mountain House, and the Town of Discovery Bay) and the untreated discharge of numerous agricultural wasteways are emptied into the waters of the San Joaquin River and the channels of the south Delta. This leads to cumulative additions to the system of thermal effluent loads as well as cumulative loads of potential contaminants (i.e., selenium, boron, endocrine disruptors, pesticides, biostimulatory compounds, etc.).

The seasonal installation of temporary rock barriers by the California Department of Water Resources (DWR) has been an ongoing activity in the channels of the south Delta since 1991. Installation of a fall rock barrier at the head of Old River has occurred intermittently since the early 1960s in order to enhance water quality downstream in the Port of Stockton and the

DWSC. These barriers have altered the hydrology of the south Delta each time they have been installed by redirecting flows and increasing water elevation behind the barriers.

Even though the habitat has been substantially altered and its quality diminished through years of human actions, its conservation value remains high for San Joaquin River basin steelhead. This segment of CCV steelhead must pass through the San Joaquin Delta HU to reach their upstream spawning and freshwater rearing areas on the tributary watersheds and to pass through the region again during the downstream migrations of both adult runbacks and juvenile smolts. Therefore, it is of critical importance to the long-term viability of the San Joaquin River basin portion of CCV steelhead to maintain a functional migratory corridor and freshwater rearing habitat throughout the action area and the San Joaquin Delta HU.

2.4.3 Factors Affecting the Species and Habitat in the Action Area

The action area encompasses a small portion of the area utilized by CCV steelhead and the sDPS green sturgeon. Many of the range-wide factors affecting these two species are discussed in section 2.2 of this opinion, and are considered the same in the action area. This section will focus on the specific factors in the action area that are most relevant to the proposed annual maintenance dredging of the Port of Stockton.

The magnitude and duration of peak flows during the winter and spring, which affects listed salmonids in the action area, are reduced by water impoundment in upstream reservoirs. Instream flows during the summer and early fall months have increased over historic levels for deliveries of municipal and agricultural water supplies. Overall, water management now reduces natural variability by creating more uniform flows year-round. Current flood control practices require peak flood discharges to be held back and released over a period of weeks to avoid overwhelming the flood control structures downstream of the reservoirs (i.e., levees) and low lying terraces under cultivation (i.e., orchards and row crops) in the natural floodplain along the basin tributaries. Consequently, managed flows in the main stem of the river often truncate the peak of the flood hydrograph and extend the reservoir releases over a protracted period. These actions reduce or eliminate the scouring flows necessary to mobilize sediments and create natural riverine morphological features within the action area. Furthermore, the unimpeded river flow in the San Joaquin River basin is severely reduced by the combined storage capacity of the different reservoirs located throughout the basin’s watershed. Very little of the natural hydrologic input to the basin is allowed to flow through the reservoirs to the valley floor sections of the tributaries leading to the Delta. Most is either stored or diverted for anthropogenic uses. Elevated flows on the valley floor are typically only seen in wet years or flood conditions, when the storage capacities of the numerous reservoirs are unable to contain all of the inflow from the watersheds above the reservoirs.

High water temperatures also limit habitat availability for listed salmonids in the San Joaquin River and the lower portions of the tributaries feeding into the main stem of the river. High summer water temperatures in the lower San Joaquin River frequently exceed 72°F, and create a thermal barrier to the migration of adult and juvenile salmonids.

Levee construction and bank protection have affected salmonid habitat availability and the processes that develop and maintain preferred habitat by reducing floodplain connectivity, changing riverbank substrate size, and decreasing riparian habitat and shaded riverine aquatic cover. Such bank protection generally results in two levels of impacts to the environment: (1) site-level impacts which affect the basic physical habitat structure at individual bank protection sites; and (2) reach-level impacts which are the cumulative impacts to ecosystem functions and processes that accrue from multiple bank protection sites within a given river reach (USFWS 2000). Armored embankments result in loss of sinuosity and braiding and reduce the amount of aquatic habitat. Impacts at the reach level result primarily from halting erosion and controlling riparian vegetation. Reach-level impacts which cause significant impacts to fish are reductions in new habitats of various kinds, changes to sediment and organic material storage and transport, reductions of lower food-chain production, and reduction in large woody debris (LWD).

The use of rock armoring limits recruitment of LWD from non-riprapped areas, and greatly reduces, if not eliminates, the retention of LWD once it enters the river channel. Riprapping creates a relatively clean, smooth surface which diminishes the ability of LWD to become securely snagged and anchored by sediment. LWD tends to become only temporarily snagged along riprap, and generally moves downstream with subsequent high flows. Habitat value and ecological functioning aspects are thus greatly reduced, because wood needs to remain in place for extended periods to generate maximum values to fish and wildlife (USFWS 2000). Recruitment of LWD is limited to any eventual, long-term tree mortality and whatever abrasion and breakage may occur during high flows (USFWS 2000). Juvenile salmonids are likely being impacted by reductions, fragmentation, and general lack of connectedness of remaining near shore refuge areas.

Point and non-point sources of pollution resulting from agricultural discharge and urban and industrial development occur upstream of, and within the action area. The effects of these impacts are discussed in section 2.2 of this opinion. Environmental stresses as a result of low water quality can lower reproductive success and may account for low productivity rates in fish. Organic contaminants from agricultural drain water, urban and agricultural runoff from storm events, and high trace element (i.e., heavy metals) concentrations may deleteriously affect early life-stage survival of fish in the Central Valley watersheds (USFWS 1995). Other impacts to adult migration present in the action area, such as migration barriers, water conveyance factors, water quality, non-native invasive species, etc., are discussed in section 2.2 of this opinion.

2.5 Effects of the Action

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

The Port's maintenance dredging operations are proposed to continue for 6 consecutive dredging seasons (i.e., from July 1 through November 30 each year) from 2018 through 2023. Dredging at a particular location is expected to occur intermittently, with an average dredging cycle of 3 to 4 years between actions for some highly accreting areas, while other sections may be dredged less than once per decade. Project impacts on the listed anadromous fish species are expected to include both direct impacts to fish present in the action area during dredging operations, and indirect impacts that may occur later in time or downstream, and negatively affect fish and designated critical habitats in the action area at any time of the year. Direct negative effects are expected to result from re-suspension of sediment and toxic chemicals, entrainment (including that of benthic food organisms), and anthropogenic noise from the operation of dredging equipment. Exposure of listed salmonids to direct effects of the Project is expected to be avoided or minimized largely because in-channel work in the mainstem San Joaquin River will occur primarily during the summer and fall, when salmonid abundance is expected to be low. Few salmonids or green sturgeon are anticipated to occur at all in the upper, manmade sections of the Stockton DWSC. Long term, indirect effects are expected to result from impacts to habitat such as bathymetry changes that might influence the quality or quantity of available rearing habitat in the action area. A brief discussion of the likelihood of exposure of listed fish by month, species, and life stage follows.

During the period from September through the end of November, adult CCV steelhead may be in the proximity of the dredging activities as proposed; however, NMFS expects them most likely to be present during the months of December through February, which is the peak of their spawning migration. Adult steelhead begin to migrate into the region's watersheds during this period, particularly when increased attractant flows are being released by upstream reservoirs to enhance fall-run Chinook salmon spawning runs in the San Joaquin River tributaries or early winter rains create increased flows in the system. Prior to the fall attractant flows, low dissolved oxygen conditions may occur and cause adult steelhead to linger downstream of the Port of Stockton while they wait for more favorable water quality conditions.

The peak of juvenile CCV steelhead emigration from their tributaries in the San Joaquin valley occurs during the period between February and May. Therefore, conducting dredging operations from July 1 through November 30 should avoid impacts to the majority of outmigrating juvenile steelhead smolts. There are, however, larger steelhead smolts that migrate at other times of the year, including the fall and early winter period, and may therefore be exposed to the dredging activities during their passage through the action area. As with adults, NMFS expects the most likely period for them to be present is in the month of December.

All CCV steelhead from the San Joaquin River basin have the potential to be exposed to the effects of the Port's maintenance dredging actions. The total number exposed to negative effects associated with the altered habitat could range from several hundred to a few thousand individuals, depending on the exact timing and location of dredging activities in any given year, the water year type, and the size and timing of the spawning run for that year.

The sDPS green sturgeon are anticipated to be present in small numbers throughout the action area during the proposed Project. Although information on the density of sDPS green sturgeon presence is not currently available, the continual but infrequent occurrence of juveniles and sub-adults in sampling studies targeting other fish species indicates that they may be present throughout the year within the Delta and, thus, vulnerable to both the short- and long-term negative effects of the Project.

2.5.1 Turbidity

Dredging has the potential to disturb and suspend a significant volume of benthic sediment. Previous estimates of dredge-created turbidity have indicated that dredging can result in an increase in total suspended solids downstream of the dredging action. The proposed maintenance dredging activities are predicted to increase suspended solids by approximately 1.5 Nephelometric Turbidity Units (NTU) 100 feet downstream from the areas being dredged in the action area.

Quantifying turbidity levels, and their effect on fish species, is complicated by several factors. First, turbidity from an instream activity will typically decrease as distance from the activity increases. How quickly turbidity levels attenuate depends on the quantity of materials in suspension (e.g., mass or volume), the particle size of suspended sediments, the amount and velocity of ambient water (dilution factor), and the physical/chemical properties of the sediments. Second, the impact of turbidity on fishes is not only related to the turbidity levels, but also the particle size of the suspended sediments.

For salmonids, the moderate levels of turbidity expected to be generated by the proposed Project may elicit a number of behavioral and physiological responses (i.e., gill flaring, coughing, habitat avoidance, and increase in blood sugar levels) which indicate some level of stress (Bisson and Bilby 1982, Sigler et al. 1984, Berg and Northcote 1985, Servizi and Martens 1992). The magnitude of these stress responses is generally higher when turbidity is increased and particle size decreased (Bisson and Bilby 1982, Servizi and Martens 1987, Gregory and Northcote 1993). Although turbidity may cause stress, Gregory and Northcote (1993) have shown that moderate levels of turbidity (35-150 NTU) accelerate foraging rates among juvenile salmonids, likely because of reduced vulnerability to predators (camouflaging effect).

NMFS expects that most fish will actively avoid areas of elevated turbidity, if possible. Although CCV steelhead are highly migratory and capable of moving freely throughout the action area, a substantial increase in turbidity may injure fish by temporarily disrupting normal behaviors that are essential to growth and survival such as feeding, sheltering, and migrating. Disrupting these behaviors increases the likelihood that individual fish will face increased competition for food and space, and experience reduced growth rates or possibly weight loss resulting in harm to individuals and increased risk to the affected species. Turbidity increases may also affect the sheltering abilities of some fish and may decrease their likelihood of survival by increasing their susceptibility to predation. Conversely, some turbidity is helpful in reducing predation by shielding the fish from visual predators in a turbid field (Gregory and Levings 1998). For those fish that do not or cannot avoid the turbid water, exposure is expected to be brief (i.e., minutes to hours) and not likely to cause injury or death from reduced growth, or physiological stress. However, some juveniles that are exposed to areas of temporarily elevated turbidity may be injured or killed by predatory fish that take advantage of disrupted normal behavior. Once fish migrate past the turbid water, normal feeding and migration behaviors are expected to resume.

The Port proposes the use of suction dredging, which involves excavating sediments with a cutterhead suction dredge. Suction dredging has the potential to create turbidity primarily where the excavation is occurring as the interface between the excavating apparatus and sediments is not contained. Turbidity resulting from dredging and dredged material disposal is expected to be intense in the vicinity of the activities themselves, but would rapidly attenuate with time and space. The conservation measures proposed to minimize the impacts of hydraulic dredging (e.g., reducing the cutterhead rotation speed and reducing swing speed) are specifically intended to reduce the volume of and broadcast area of suspended sediment and should preclude large changes to the conditions in the DWSC compared to background turbidity levels.

The Port proposes to implement a number of additional techniques to minimize turbidity effects resulting from Project operations. First, the Port would monitor turbidity levels in accordance with the requirements of the Water Quality Certification (WQC) issued for programmatic maintenance dredging (WQC #5B39CR00268). In the event that monitoring shows that turbidity thresholds established by the WQC are being exceeded, dredging operations would be modified to avoid prolonged negative effects. Second, the Port would dispose of dredge material in a manner to limit the exposure of listed fish by placing the material in upland disposal sites and by meeting water quality standards for effluent discharge from these sites. The Port would also use best management practices at disposal locations to prevent remobilization of sediments, and subsequent turbidity, through dewatering activities or storage.

Based on the timing of the proposed dredging actions (July 1 through November 30), NMFS expects the majority of the impacts created by dredging activity to be experienced by adult CCV steelhead migrating upstream to the watersheds of the San Joaquin River during the later portion of the dredging season. Although some steelhead smolts may be migrating downstream at this time, their numbers are expected to be low compared to the peak of migration in spring and would tend to be associated with rain events or pulse flow operations on the tributaries. Increased flows in the main channel of the San Joaquin River resulting from pulse flows or winter precipitation would be expected to ameliorate the negative effects of the dredging action by shortening the duration of migration through the action area and diluting the re-suspended sediments in the water column. The exposure risk to sDPS green sturgeon is less clear. No specific information is available to evaluate the potential responses of sDPS green sturgeon to increased turbidity and suspended sediment. It is possible that higher concentrations of suspended sediment and turbidity may interfere with normal feeding and migratory behavior, although sturgeon may be less sensitive to short-term increases in suspended sediments or turbidity because they are a benthically oriented species, evolutionarily adapted for life in turbid flowing waters, and may rely on biomagnetic electroreception or olfactory cues more consistently than vision to locate prey. Any reductions in the availability of foraging habitat and food because of sedimentation of benthic habitat following a dredging episode would likely have little or no effect on growth or survival due to the temporary, localized nature of these effects in an already degraded habitat. Juvenile and adolescent green sturgeon could be found year-round in the Delta, particularly in the deeper sections of the river based on sturgeon behavior and their preference for deep holes in river channels.

2.5.2 Contaminants

Disturbing benthic sediments through dredging is expected to mobilize and distribute a variety of contaminants. Some of these contaminants may be acutely or chronically harmful to salmonids

(Allen and Hardy 1980). The Corps has tested sediments for contaminants across all areas where dredging is proposed, and has not found contaminants in concentrations that exceed any of the existing regulatory criteria imposed by the requirements for Section 401 Water Quality Certification under the Clean Water Act. However, some contaminants lack defined regulatory exposure criteria that are relevant to listed anadromous fish that could still result in direct or indirect adverse effects (Ewing 1999).

If contaminants are released during dredging or disposal activities, their effects may be subtle and difficult to directly observe. The effects of bioaccumulation are of particular concern as pollutants can reach concentrations in higher trophic level organisms (e.g., salmonids) that far exceed ambient environmental levels (Allen and Hardy 1980). Bioaccumulation may therefore cause delayed stress, injury, or death as contaminants are transported from lower trophic levels (e.g., benthic invertebrates or other prey species) to predators long after the contaminants have entered the environment or food chain. It follows that some organisms may be negatively affected by contaminants while regulatory thresholds for the contaminants are not exceeded during measurements of water or sediments.

Sublethal or nonlethal effects indicate that death is not the primary toxic endpoint. Rand (1995) stated that the most common sublethal endpoints in aquatic organisms are behavioral (e.g., swimming, feeding, attraction-avoidance, and predator-prey interactions), physiological (e.g., growth, reproduction, and development), biochemical (e.g., blood enzyme and ion levels), and histological changes. Some sublethal effects may result in indirect mortality. Changes in certain behaviors, such as swimming or olfactory responses, may diminish the ability of the salmonids to find food or escape from predators and may ultimately result in death. Some sublethal effects may have little or no long-term consequences to the fish because they are rapidly reversible or diminish and cease with time. Individual fish of the same species may exhibit different responses to the same concentration of toxicant. The individual condition of the fish can significantly influence the outcome of the toxicant exposure. Fish with greater energy stores will be better able to survive a temporary decline in foraging ability, or have sufficient metabolic stores to swim to areas with better environmental conditions. Fish that are already stressed are more susceptible to the deleterious effects of contaminants, and may succumb to toxicant levels that are considered sublethal to a healthy fish.

Exposure to sublethal levels of contaminants might have serious implications for salmonid health and survival. Studies have shown that low concentrations of commonly available pesticides can induce significant sublethal effects on salmonids. Scholz et al. (2000) and Moore and Waring (1996) have found that diazinon interferes with a range of physiological biochemical pathways that regulate olfaction, negatively affecting homing, reproductive, and anti-predator behavior of salmonids. Waring and Moore (1997) also found that the carbofuran had significant effects on olfactory mediated behavior and physiology in Atlantic salmon (*Salmo salar*). Ewing (1999) reviewed scientific literature on the effects of pesticides on salmonids and identified a wide range of sublethal effects such as impaired swimming performance, increased predation of juveniles, altered temperature selection behavior, reduced schooling behavior, impaired migratory abilities, and impaired seawater adaptation.

Other non-pesticide compounds that are common constituents of urban pollution and agricultural runoff also negatively affect salmonids. Exposure to chlorinated hydrocarbons and aromatic hydrocarbons causes immunosuppression and increased disease susceptibility (Arkoosh et al. 1994). In areas where chemical contaminant levels are elevated, disease may reduce the health and survival of affected fish populations (Arkoosh et al. 1994).

As noted above, the literature suggests that certain contaminants may affect the biology of salmonids. At present, regulatory thresholds are likely inadequate to account for these effects (i.e., some contaminants do not have salmonid exposure criteria or bioaccumulation criteria). Therefore, NMFS expects the proposed Project to have sublethal effects on listed salmonids as described above. NMFS also anticipates green sturgeon to experience sublethal effects to the same or a greater extent than listed salmonids due to their potential to be present throughout the year in the action area, and dermal contact with sediment because of their preference for and frequent use of benthic habitats, as well as their consumption of benthic invertebrate prey species.

Until exposure criteria can be refined and expanded, the Port has committed to implementing conservation measures that are intended to minimize the exposure of listed anadromous fish species to contaminants to the greatest extent possible, for example, by dredging during the in-water work window, continuing to sample sediments for contaminants, refraining from in-water disposal of contaminated sediments, and implementing best management practices to prevent fuel spills, hydraulic leaks, etc., during all dredging and disposal operations.

2.5.3 Entrainment and Harassment

The probability of entraining CCV steelhead in either a hydraulic or clamshell dredge is likely to be very low because these fish are likely to avoid the immediate vicinity of dredging operations, and because dredging operations proceed very slowly compared to the swimming ability of salmonids in general. Additionally, the Port has committed to a number of conservation measures to reduce the probability of entrainment occurring during dredge operations. Direct effects to CCV steelhead by entrainment are minimized by keeping the cutterhead in close proximity to the bottom of the water column to the greatest extent possible. The cutterhead suction pumps would only be turned on when necessary, and only be raised not more than 3 feet off the channel bottom when necessary during maintenance dredging operations. This measure is primarily to protect juveniles from entrainment, as adults have sufficient swimming capacity to avoid entrainment unless they swim directly into the cutterhead.

Furthermore, most dredging will take place in water deeper than 20 feet. CCV steelhead smolts are not expected at this depth during their seaward migration, thus further insulating them from the effects of the flow fields surrounding the cutterhead. Adult CCV steelhead that may encounter the hydraulic dredge would likewise be able to avoid and escape entrainment due to their greater swimming speed. Overall, no adults and few juvenile listed CCV steelhead are expected to be entrained in the dredge. Any fish entrained in the dredge would be expected to die due to physical injury or suffocation in sediment coupled with the unlikelihood of release back into the river channel once entrained.

Juvenile and adolescent green sturgeon may be at an elevated risk of entrainment from the hydraulic dredge. Based on monitored entrainment rates observed in the Columbia River Basin (Reine and Clark 1998), juvenile white sturgeon (*Acipenser transmontanus*) were entrained by hydraulic dredging at high rates from localized areas known to have aggregations of sturgeon (sturgeon holes). The behavior of sturgeon apparently places them at risk of entrainment from dredging actions due to their preference for deep channels and holes (i.e., the DWSC) and their reluctance to move away from those areas even when disturbed. Since NMFS assumes that sDPS green sturgeon will occupy the Delta year-round during their juvenile and sub-adult phases, exposure to entrainment in the action area may occur throughout the entire dredging window for the Stockton DWSC. While the number of individual fish actually entrained by mechanical or hydraulic dredging operations is anticipated to be extremely low due to the relatively expansive and unconstricted nature of the water ways in the action area, post-entrainment mortality rates for any individuals that are entrained are expected to be very high, approaching 100 percent.

2.5.4 Rearing Habitat

The Port proposes to annually dredge approximately 53,100 cubic yards of silt and sand accumulations in portions of the Project area. The number, location, and size of these sites will vary from year to year and will represent varying degrees of suitability as juvenile rearing habitat for the listed anadromous fish species. Suitability is determined in part by depth, substrate type, and distance from the shoreline.

The most important habitat attribute of the riverbed to listed anadromous fish species in the action area is the production of food items for rearing and migrating juveniles. Oligochaetes and chironomids (dipterans) are the dominant CCV steelhead and sDPS green sturgeon food items produced in the silty and sandy substrates in this area. These organisms would be entrained by the hydraulic suction dredge, particularly small demersal fish and benthic invertebrates. Reine and Clark (1998) estimated that the mean entrainment rate of a typical benthic invertebrate in the estuaries of the Pacific northwest, represented by sand shrimp (*Crangon spp.*), was 0.69 shrimp/cubic yard when the cutterhead was positioned at or near the bottom, but rose sharply to 3.4 shrimp/cubic yard when the cutterhead was raised above the substrate to clean the pipeline and cutterhead assembly. These rates correspond with a potential loss to the overall shrimp population ranging from 1.2 to 6.5 percent during the course of a "typical" dredging project in the estuaries of the Pacific northwest. Likewise, benthic infauna, such as clams, would be entrained by the suction dredge in rates equivalent to their density on the channel bottom, as they have no ability to escape. The loss of benthic food resources, such as amphipods or isopods, could reduce fish growth rates and increase the energy expended searching for food, depending on the density of the animal assemblages on the channel bottom. This would be more likely to occur to sturgeon, which are specialized benthic feeders, but also may affect juvenile CCV steelhead, although to a lesser degree. Small invertebrates such as annelids, crustaceans (amphipods, isopods), and other benthic fauna would be unable to escape the suction of the hydraulic dredge and be lost to the system. Also, many benthic invertebrates have pelagic, surface-oriented larvae; therefore the loss of these benthic invertebrates may reduce the abundance of localized zooplankton populations in the upper regions of the water column where juvenile salmonids migrate through the Delta. The timing of the dredging cycle (from July 1 through November 30 each year) may preclude forage base replacement by recruitment from surrounding areas prior to the following winter and spring migration period of juvenile steelhead through the action area (Nightingale and Simenstad 2001). However, as these organisms occupy habitat types that are prone to disturbance under natural conditions, they would likely rapidly recolonize dredged areas by drifting and crawling from adjacent undisturbed areas (Mackay 1992).

The time needed to recolonize the dredged area is unknown and is complicated by the variable maintenance dredging cycles and reach locations. These variable dredging cycles may preclude a "natural climax" benthic invertebrate assemblage from re-establishing itself in a given specific reach of the DWSC. However, outmigrating CCV steelhead and rearing green sturgeon should be able to find alternative foods and foraging areas outside of the channel and in adjoining channels feeding into the DWSC. Overall, maintenance dredging is not likely to change the benthic habitat to the extent that listed species would be negatively affected in the reaches to be dredged, particularly in the manmade sections of the Stockton DWSC.

2.6 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the section describing the rangewide status of the species and critical habitat (Section 2.2).

2.6.1 Agricultural Practices

Agricultural practices in the Delta likely negatively affect riparian and wetland habitats through upland modifications of the watershed that lead to increased siltation or reductions in water flow in stream channels flowing into the Delta. Unscreened agricultural diversions throughout the Delta entrain fish including juvenile salmonids. Grazing activities from dairy and cattle operations can degrade or reduce suitable habitat for listed salmonids by increasing erosion and sedimentation as well as introducing nitrogen, ammonia, and other nutrients into the watershed, which then flow into the receiving waters of the Delta. Stormwater and irrigation discharges related to both agricultural and urban activities contain numerous pesticides and herbicides that may negatively affect the reproductive success and survival rates of anadromous fish species (Dubrovsky et al. 1998, 2000; Daughton 2003).

2.6.2 Increased Urbanization

The Delta, East Bay, and Sacramento regions, which include portions of Contra Costa, Alameda, Sacramento, San Joaquin, Solano, Stanislaus, and Yolo counties, are expected to increase in population by nearly 3 million people by the year 2020. Increases in urbanization and housing developments can impact habitat by altering watershed characteristics, and changing both water use and stormwater runoff patterns. For example, the General Plans for the cities of Stockton, Brentwood, Lathrop, Tracy and Manteca and their surrounding communities anticipate rapid growth for several decades to come. The anticipated growth will likely occur along both the I-5 and US-99 transit corridors in the east and Highway 205/120 in the south and west. Increased growth will place additional burdens on resource allocations, including natural gas, electricity, and water, as well as on infrastructure such as wastewater sanitation plants, roads and highways, and public utilities. Some of these actions, particularly those which are situated away from waterbodies, will not require Federal permits, and thus will not undergo ESA section 7 consultation with NMFS.

Increased urbanization also is expected to result in increased recreational activities in the region. Among the activities expected to increase in volume and frequency is recreational boating. Boating activities typically result in increased wave action and propeller wash in waterways. This will potentially degrade riparian and wetland habitat by eroding channel banks and mid-channel islands, thereby causing an increase in siltation and turbidity. Wakes and propeller wash also churn up benthic sediments, thereby potentially resuspending contaminated sediments and degrading areas of submerged vegetation. This, in turn, would reduce habitat quality for the invertebrate forage base required for the survival of juvenile salmonids and green sturgeon moving through the Delta. Increased recreational boat operation in the Delta is anticipated to result in more contamination from the operation of gasoline and diesel powered engines on watercraft entering the water bodies of the Delta.

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to listed species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminishes the value of designated or proposed critical habitat for the conservation of the species.

2.7.1 Summary of the Status of the Species and the Environmental Baseline

The Status of Species and Environmental Baseline sections show that past and present impacts to the San Joaquin River basin and south Delta have caused significant salmonid and green sturgeon habitat loss, fragmentation and degradation. This has significantly reduced the quality and quantity of freshwater rearing sites and the migratory corridors within the lower valley floor reaches of the San Joaquin River and the south Delta for these listed species. Additional loss of freshwater spawning sites, rearing sites, and migratory corridors have also occurred upstream of the south Delta in the upper main stem and tributaries of the San Joaquin River.

Anthropogenic activities in the San Joaquin River watershed have contributed substantially to declines in CCV steelhead and sDPS green sturgeon populations and have led to the extirpation of the Central Valley spring-run Chinook salmon populations endemic to the San Joaquin River Basin's watersheds (e.g., completion of Friant Dam and the Kern and Friant canals in the late 1940s). Dam operations have reduced the extent of suitable water temperatures for over summering steelhead juveniles to the tailwaters immediately below these dams. In some cases the water temperatures reach incipient lethal temperatures only a few miles downstream of the dams. Alterations in the geometry of the south Delta channels, removal of riparian vegetation and shallow water habitat, construction of armored levees for flood protection, changes in river flow created by demands of water diverters (including pre-1914 riparian water right holders, CVP and SWP contractors, and municipal entities), and the influx of contaminants from agricultural and urban dischargers have substantially reduced the functionality of the action area's aquatic habitat. The proposed action, the annual maintenance dredging of the Port of Stockton, has now been occurring for several decades and, thus, the effects of these past operations are also a part of the environmental baseline. The effects of past and present activities examined in the environmental baseline are expected to extend into the future for the duration of the proposed Port of Stockton maintenance dredging program through the year 2023.

2.7.2 Summary of Effects of the Proposed Action on Listed Species and Critical Habitat

The proposed action is expected to continue to affect the value of the action area as freshwater migration and rearing habitat for an additional 6 years. These effects are a continuation of the effects that have occurred since the Port's construction due to the annual implementation and ongoing nature of operations at an active port. Specifically, maintenance dredging operations will continue to maintain the degraded condition of existing habitat characteristics during the 5-month operational period (July through November) when dredging may occur. The remaining 7 months of the year (December through June) will allow for some recovery of habitat conditions locally, however the impacts of the routine disturbance of the bottom substrates each year will not be fully ameliorated by this short reprieve as the cyclical nature of these events do not allow for a stable, natural habitat to become re-established in the action area. The description of the proposed action's effects includes any influence of current environmental conditions and their associated variability. While climate change is expected to continue over the relatively short duration of the action's direct and indirect effects, we cannot distinguish changes in temperatures, precipitation, or other factor attributable to climate change from annual and decadal climate variability over this time period. For these reasons, climate change is not expected to amplify the effects of the proposed action.

The impacts described in the Cumulative Effects section are expected to further diminish the functional value of critical habitat within the action area. For instance, increased demands for water, whether for agricultural purposes or for domestic consumption are expected to continue in the south Delta. The region's pre-1914 riparian water right holders have the senior rights to divert water downstream of the action area, and are not expected to decrease their water diversion entitlements for environmental purposes. Likewise, regional urban development is expected to continue, although the rate of development may slow due to economic pressures in the area. Therefore, the demand for domestic and municipal water supplies diverted from the south Delta and San Joaquin River Basin are expected to increase to meet these demands in future years, although the rate of increase may moderate in the near term due to economic trends. As urban development increases in the area the ability to modify or enhance the riparian zone of the south Delta channels will be lessened in response to flood management needs for urbanized areas. This circumstance will perpetuate the already degraded status of the critical habitat in the action area, add to the negative effects of the proposed action, and reduce the potential of future environmental restoration actions such as setback levees or flood benches along the river channels.

2.7.2.1 California Central Valley Steelhead

The steelhead population in the San Joaquin River basin is susceptible to activities in the south Delta which impact the ability of adults and juveniles to successfully move through the region, including increased rates of mortality due to higher predation, degradation of water quality, and delayed migration through the system without sufficient rearing capacity. These negative impacts diminish the ability of the population to respond to larger environmental stressors in the watershed. Small, discrete subpopulations, such as those steelhead populations found in the San Joaquin River basin, are highly susceptible to extirpation from ongoing actions which decrease the spawning success rate, rearing capacity or ability of the individual fish to migrate to and from the ocean effectively. Currently the CCV steelhead DPS is in decline and the role of these smaller populations becomes important in maintaining spatial and genetic diversity within the DPS. They may serve as sources of genetic variability, spatially separated population pools to minimize the risk of local extinctions, and sources of new founder populations in the event of a local extinction event.

The magnitude and significance of the effects of routine maintenance dredging operations at the Port of Stockton on CCV steelhead is impossible to quantify due to a lack of monitoring and scientific data. Current unknowns include the proportion of each year class that will be exposed to the direct and indirect effects of maintenance dredging operations, and the degree of negative effects on those fish that do. The effects of dredging operations are likely to have negative effects on listed fish in the action area, including temporary and localized increases in turbidity and suspended sediments, elevated concentrations of contaminants released to the aquatic environment, anthropogenic acoustic disturbances, increased vulnerability to predation as a result of disorientation from exposure to any of the above, potential entrainment into the dredge, and diminished prey availability or increased competition for reduced numbers or densities of prey. The limited information that is available indicates that annual dredging operations conducted at the Port of Stockton are likely to reduce the growth and survival rates of those fish that are exposed to the effects of the action as they migrate through or rear in the action area.

2.7.2.2 Southern DPS of North American Green Sturgeon

Juvenile and sub-adult life stages of the sDPS of green sturgeon rear year round in the waters of the Delta, including the San Joaquin River, and are, therefore, expected to be exposed to the effects of the maintenance dredging activities in the Port of Stockton over the 6-year period from 2018 through 2023. There are no reliable estimates of juvenile production, and no estimates of the number of individuals rearing in the vicinity of the action area, so the population level of exposure is unknown. Those green sturgeon juveniles and sub-adults that do enter the action area are likely to experience degraded habitat conditions, reductions in the quantity and quality of prey items available, and potential increased exposure to elevated levels of contaminants.

2.7.3 Summary

The combined effects of the proposed action will have mixed consequences on listed fish in the action area. Exposure to the direct and indirect effects of the action will likely increase the extent of mortality related to predation, exposure to degraded water quality conditions, and potential delays in migration to the ocean, experienced by listed species. These effects are expected to occur primarily during the 5 months of the year when maintenance dredging operations will be occurring (July through November). The remaining 7 months of the year will see only residual effects associated with habitat alterations incurred during those previous dredging operations (e.g., changes in macroinvertebrate density and populations, extent of exposure to temporarily elevated concentrations of contaminants, etc.). The routine disturbance of the channel bottom as a result of annual maintenance dredging operations at the Port of Stockton will also seasonally diminish or degrade the functionality of the PBFs of designated critical habitat for CCV steelhead and the sDPS green sturgeon in the action area.

2.8 Conclusion

After reviewing the best available scientific and commercial information, the current status of CCV steelhead and the sDPS green sturgeon, the environmental baseline, the effects of the annual implementation of maintenance dredging activities in the Port of Stockton over a period of 6 years, and the cumulative effects, it is NMFS' biological opinion that implementation of the Port of Stockton maintenance dredging program during the 6-year period from 2018 through 2023 is not likely to jeopardize the continued existence of CCV steelhead or the sDPS green sturgeon, nor will it result in the destruction or adverse modification of designated critical habitat for CCV steelhead or the sDPS green sturgeon.

2.9 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1 Amount or Extent of Take

In this opinion, NMFS determined that the proposed action is reasonably certain to result in the incidental take of individual CCV steelhead and green sturgeon. Incidental take associated with this action is expected to be in the form of mortality, harm, or harassment of adult CCV steelhead and juvenile green sturgeon as a result of exposure to the direct and indirect effects of routine annual maintenance dredging operations at the Port of Stockton in the San Joaquin River. Some of the harm associated with this exposure is expected to result from entrainment in the dredging equipment, harassment from the generation of turbidity resulting from the resuspension of sediments, increased vulnerability to predation, reduced prey availability, and exposure to elevated concentrations of contaminants in the waters, substrates, and prey species of the action area. Exposure to the adverse effects associated with maintenance dredging operations in the action area is limited to the 5-month operational period from July 1 through November 30 when dredging will be conducted each year. Incidental take of adult CCV steelhead is expected to occur during the period from early September through the end of November each year, when the start of winter rains may trigger the migration of a small number of individuals from this population through the action area to varying extents during their upstream spawning movements into the San Joaquin River basin. Juveniles and sub-adults from the sDPS green sturgeon are expected to be present in the action area throughout the year, however, and incidental take of this species is expected to occur over the entire 5-month in-water work window during which dredging operations will be carried out each year (July through November).

NMFS cannot, using the best available information, accurately quantify the anticipated incidental take of individual listed fish because of the variability and uncertainty associated with the population size of each species, annual variations in the timing of migration, and uncertainties regarding individual habitat use within the action area. However, it is possible to designate ecological surrogates for the extent of take anticipated to be caused by the Port's maintenance dredging activities, and to monitor those surrogates to determine the level of take that is occurring. The most appropriate ecological surrogates for providing a quantifiable metric for determining the extent of incidental take of listed fish caused by maintenance dredging operations at the Port of Stockton are: (1) the extent and duration of turbidity increases in the aquatic environment relative to environmental background conditions in the action area during dredging operations, (2) the total area of channel bottom dredged on an annual basis, (3) the total quantity or volume of sediment removed from the river on an annual basis, and (4) the total amount of time that dredging operations are conducted each year. Of these, turbidity in the aquatic environment resulting from maintenance dredging operations can be consistently and accurately measured during Project implementation and, therefore, serves as a physically measurable proxy for the incidental take of listed fish.

Ecological Surrogate

- The analysis of the effects of the proposed maintenance dredging program will result in temporary increases to the ambient background levels of turbidity in the aquatic environment downstream from the areas to be dredged. Based on the methods described for performing annual maintenance dredging operations, the types of equipment that will be employed to carry out those activities, and the effects analysis conducted for this consultation, the observed increases in turbidity above ambient background conditions in the aquatic environment shall not exceed 15 NTUs in successive samples at a distance of approximately 328 feet downstream from the specific locations where active dredging operations are being conducted.

If the limits to the extent of incidental take represented by the ecological surrogate are exceeded, the proposed Port of Stockton maintenance dredging program will be considered to have exceeded anticipated take levels, triggering the need to reinitiate consultation.

2.9.2 Effect of the Take

In this biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to jeopardize the continued existence of CCV steelhead or the sDPS green sturgeon or result in the destruction or adverse modification of their designated critical habitats.

2.9.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

1. The Corps and the Port shall avoid or minimize dredging-related impacts associated with the annual implementation of maintenance dredging operations in the Port of Stockton upon CCV steelhead and North American green sturgeon.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the Corps and the Port must comply with them in order to implement the RPMs (50 CFR 402.14). The Corps and the Port have a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The following terms and conditions implement reasonable and prudent measure 1:

a. Monitoring of turbidity levels of the waters where the dredge is operating shall be conducted to verify that water quality criteria are not exceeded, as described in the description of ecological surrogates, above. If levels are exceeded, NMFS shall be notified and work halted until corrective actions are instituted to achieve surface water quality criteria.

b. All heavy equipment shall be fueled, maintained, and stored at a safe distance from any adjacent waterways. Standard construction BMPs, as described in the current

California Department of Transportation Construction Site Best Management Practices Manual (California Department of Transportation 2017), shall be implemented so that no oil, grease, fuel or other fluids contaminate the waterways around the work sites.

c. Dredging operations shall be conducted within the specified work window of July 1 through November 30 each year. If dredging is necessary outside of this window, NMFS shall be contacted, in writing, for approval at least 30 days prior to the activity. The request must include the location and size of the work area within action area, estimates of the amount of time required and dredging material to be removed, and most recent monitoring data indicating the likely presence and magnitude of listed anadromous fish species in the action area. The request is to be sent to the following address:

National Marine Fisheries Service
California Central Valley Office
650 Capitol Mall, Suite 5-100
Sacramento, California 95814-4706

d. The Port shall visually monitor the waterway adjacent to the area being dredged (i.e., within 300 feet) during all dredging operations for any affected fish, including, but not limited to, Central Valley spring-run Chinook salmon, CCV steelhead, and the sDPS green sturgeon. Observation of affected fish shall be reported to NMFS by telephone at (916) 930-3600, by FAX at (916) 930-3629, or at the address given above within 24 hours of the incident. Dredging operations shall be halted immediately until the Port coordinates with NMFS to determine the cause of the incident and whether any additional protective measures are necessary to protect listed salmonids and green sturgeon. Any protective measures that are determined necessary to protect listed salmonids and sturgeon shall be implemented as soon as practicable within 72 hours of the incident. Affected fish are defined as:

i. Dead or moribund fish at the water surface;
ii. Showing signs of erratic swimming behavior or other obvious signs of distress;
iii. Gasping at the water surface; or
iv. Showing signs of other unusual behavior.

A follow-up written notification shall also be submitted to NMFS which includes the date, time, and location that the carcass or injured specimen was found, a color photograph, the cause of injury or death, if known, and the name and affiliation of the person who found the specimen. Written notification shall be submitted to NMFS at the above address. Any dead specimen(s) shall be placed in a cooler with ice and held for pick up by NMFS personnel or an individual designated by NMFS to do so.

e. Prior to each dredging season, the Port shall provide NMFS documentation of exact reaches proposed for maintenance dredging, schedules for that dredging year, and which DMPSs are to be used. Dredging operations shall not commence until NMFS has confirmed receipt of this documentation and concurred that the planned activities comport with this programmatic opinion. At the completion of each dredging season, the Corps shall provide NMFS documentation of the exact reaches that were dredged, the amount of material that was dredged, and which DMPSs were used. Also, NMFS shall be sent copies of any sediment, effluent, or water quality monitoring reports required by the Regional Board that are related to the dredging actions of this Project at the above address within 60 days of their completion.

f. The Port shall continue to perform entrainment monitoring during annual maintenance dredging for the duration of the proposed Project, and submit an annual report by June 1 of the following year summarizing the results of the previous year's effort to NMFS at the above address.

2.10 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

1. The Corps should support and promote aquatic and riparian habitat restoration within the Sacramento / San Joaquin River Delta, and encourage its contractors to modify operation and maintenance procedures through the Corps' authorities in order to avoid or minimize negative impacts to salmonids and sturgeon in this region.

2. The Corps should provide funding to support anadromous fish monitoring programs throughout the Sacramento / San Joaquin River Delta to improve the understanding of migration and habitat utilization by salmonids and sturgeon in this region.

3. The Corps should provide funding to support the maintenance of the acoustic receiver array in the Sacramento / San Joaquin River Delta and the San Francisco Bay-Delta Estuary, which is currently operated and maintained by UC Davis.

4. The Corps should coordinate with the Interagency Ecological Program (IEP) to further evaluate the ecosystem function of the Stockton DWSC and the Port of West Sacramento to enhance estuarine habitat values and fish passage for salmon, steelhead and sturgeon.

5. The Corps should continue to work cooperatively with other State and Federal agencies, private landowners, governments, and local watershed groups to identify opportunities for cooperative analysis and funding to support salmonid habitat restoration projects within the Delta region.

2.11 Reinitiation of Consultation

This concludes NMFS formal consultation on the maintenance dredging of docks 2 through 20 at the Port of Stockton for the years 2018-2023. As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.12 "Not Likely to Adversely Affect" Determinations

Adult Central Valley spring-run Chinook salmon are not expected to be present in the action area during the in-water work window of July 1 to November 30 each year. Yearling and young-of-year spring-run Chinook salmon may begin to appear in the action area as early as late October, so some individuals may be exposed to the effects of the action as they migrate through the action area. This exposure is not expected to result in negative effects, however, as the exposure to any individual fish would be limited in both duration and intensity to the extent that the action area occupies only a small fraction of the entire migratory route for these life stages. The intensity of the exposure is further minimized by the nature of the channel geometry and the relative size of the action area to the rest of the migratory route in both width and depth, affording strong swimmers such as salmonids ample opportunity to avoid or escape exposure as they approach any ongoing dredging operations or other disturbances in the water column. In addition, these fish are not present in the action area in any substantial numbers until after February when the bulk of yearling and young-of-year spring-run Chinook salmon begin to enter the Delta each year. Approximately 98 percent of the annual spring-run Chinook salmon salvage occurs in the months of March, April, and May, as indicated by the salvage records from 1999 through 2009. By the end of May, the proportion of spring-run Chinook salmon outmigrants through the south Delta has declined markedly, with the outmigration of spring-run Chinook salmon smolts essentially concluding by the end of June.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR

600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the Corps and the Port, and descriptions of EFH for Pacific Coast salmon contained in the fishery management plan (FMP) developed by the Pacific Fishery Management Council (PFMC) and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The PFMC has identified and described EFH, Adverse Impacts and Recommended Conservation Measures for salmon in Amendment 14 to the Pacific Coast Salmon FMP (PFMC 1999). The proposed Project site is within the region identified as EFH for Pacific salmon in Amendment 14 of the Pacific Coast Salmon FMP. Freshwater EFH for Pacific salmon in the California Central Valley includes waters currently or historically accessible to salmon within the Central Valley ecosystem as described in Myers et al. (1998), and includes the San Joaquin Delta (Delta) hydrologic unit (i.e., number 18040003). Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley spring-run Chinook salmon (*O. tshawytscha*), and Central Valley fall-/late fall-run Chinook salmon (*O. tshawytscha*) are species managed under the Pacific Coast Salmon FMP that occur in the Delta unit.

The Corps has determined that the proposed project will adversely affect the EFH for federally managed fish species within the Pacific Coast Salmon FMP, including the estuarine habitat area of particular concern, defined as the upriver extent of saltwater intrusion where ocean-derived salts measure less than 0.5 parts per thousand during the period of average annual low flow.

3.2 Adverse Effects on Essential Fish Habitat

Maintenance dredging of the Port of Stockton will adversely affect EFH through the re-suspension of sediments potentially resulting in temporary (1) increases in turbidity, (2) reductions of prey availability, and (3) increased levels of re-suspended contaminants. The effects of the proposed action on CCV steelhead habitat are described in detail in section 2.5 (Effects of the Action) of the preceding biological opinion, and generally are expected to apply to Pacific salmon EFH. The action area for the Project is the Port of Stockton in the San Joaquin River, however, which is an existing navigational channel that has been the subject of previous MSA consultations. Those consultations assessed the impacts of routine maintenance dredging activities to EFH in the action area and resulted in conservation recommendations from NMFS intended to avoid, minimize, mitigate, or otherwise offset adverse effects to Pacific salmon EFH, which the Corps previously received and implemented.

3.3 Essential Fish Habitat Conservation Recommendations

NMFS has determined that impacts to EFH in the action area associated with the Project, including the periodic loss of ecological function for the planned maintenance dredging schedule into the future, have previously been evaluated by NMFS in a previous consultation that offered conservation recommendations already adopted and implemented by the Corps. Therefore, no additional conservation recommendations beyond what has been offered and implemented previously are being provided at this time.

3.4 Supplemental Consultation

The Corps must reinitiate EFH consultation with NMFS if the proposed action is revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for prior conservation recommendations provided by NMFS, including changes to dredging methods, changes to the environment, or changes to our understanding of how the proposed project may affect EFH [50 CFR 600.920(l)].

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the Corps and the Port. Individual copies of this opinion were provided to the Corps and the Port. This opinion will be posted on the Public Consultation Tracking System website (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). The format and naming adheres to conventional standards for style.

4.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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